

WHAT IS CLAIMED IS:

1 1. For use with a switch having a first number of input
2 ports, a second number of output ports, each of the input
3 ports having the second number of virtual output queues,
4 and a third number of subschedulers, each of the third
5 number of subschedulers being able to arbitrate matching to
6 each of the second number of output ports, a method for
7 scheduling the dispatch of cells or packets stored in the
8 virtual output queues, the method comprising:

9 a) for each of the virtual output queues, maintaining
10 a first indicator for indicating whether the virtual
11 output queue is storing a cell awaiting dispatch
12 arbitration;

13 b) for each of the subschedulers, maintaining a
14 second indicator $F(i,j,k)$ for indicating whether the
15 subscheduler is available or reserved; and

16 c) for each of the subschedulers, performing a
17 matching operation, if it has been reserved, to match
18 a cell buffered at a virtual output queue with its
19 corresponding output port,

20 wherein each of the subschedulers requires more
21 than one cell time slot to generate a match from its
22 matching operation, and

23 wherein the subschedulers can collectively
24 generate a match result for each output port in each cell
25 time slot.

1 2. The method of claim 1 wherein each of the subschedulers
2 requires the third number of cell time slots to generate a
3 match from its matching operation.

1 3. The method of claim 1 wherein each of the subschedulers
2 require no more than the third number of cell time slots to
3 generate a match results from its matching operation.

1 4. The method of claim 1 wherein fairness for best-effort
2 traffic is maintained.

1 5. The method of claim 1 wherein the matching operation is
2 a matching operation selected from a group of matching
3 operations consisting of (A) DRRM, and (B) iSLIP.

1 6. The method of claim 1 further comprising:

2 d) if a cell buffered at a virtual output queue has
3 been successfully matched with its corresponding
4 output port, informing the virtual output queue.

1 7. The method of claim 6 further comprising:

2 e) for each of the virtual output queues, if the
3 virtual output queue has been informed that it has
4 been successfully matched with its corresponding
5 output port, then dispatching its head of line cell.

1 8. The method of claim 7 wherein the head of line cell is
2 dispatched in a next cell time slot.

1 9. The method of claim 1 further comprising:

2 e) if a cell buffered at a virtual output queue has
3 been successfully matched with its corresponding
4 output port, then dispatching its head of line cell.

1 10. The method of claim 9 wherein the head of line cell is
2 dispatched in a next cell time slot.

1 11. The method of claim 1 wherein the first indicator, for
2 each of the virtual output queues, for indicating whether
3 the virtual output queue is storing a cell awaiting
4 dispatch, is a count,
5 wherein the count is incremented upon learning
6 that a new cell has arrived at the virtual output queue.

1 12. The method of claim 11 wherein the count is
2 decremented when an available subscheduler is reserved for
3 considering a head of line cell at a corresponding virtual
4 output queue.

1 13. The method of claim 1 wherein the second indicator,
2 for each of the subschedulers, is set to indicate that the
3 associated subscheduler is reserved if the first indicator
4 indicates that a corresponding virtual output queue is
5 storing a cell awaiting dispatch arbitration.

1 14. The method of claim 1 wherein the second indicator,
2 for each of the subschedulers, is set to indicate that the
3 associated subscheduler is available if the associated
4 subscheduler matches a cell buffered at a virtual output
5 queue with its corresponding output port.

1 15. The method of claim 1 wherein the second indicator is
2 set to indicate that a k^{th} subscheduler is reserved if the
3 first indicator indicates that a corresponding virtual
4 output queue is storing a cell awaiting dispatch
5 arbitration,
6 wherein k is set to the current cell time slot
7 modulo the third number.

1 16. For use with a switch including a first number of
2 output ports, a second number of input ports, and the first
3 number of virtual output queues associated with each of the
4 second number of input ports, a dispatch scheduler
5 comprising:

- 6 a) a third number of subschedulers;
- 7 b) a first indicator, associated with each of the
8 virtual output queues, for indicating whether the
9 virtual output queue is storing a cell awaiting
10 dispatch arbitration; and
- 11 c) a second indicator, for each of the subschedulers,
12 indicating whether the subscheduler is available or
13 reserved,

14 wherein each of the subschedulers is adapted to
15 perform a matching operation, if it has been reserved, to
16 match a cell buffered at a virtual output queue with its
17 corresponding output port,

18 wherein each of the subschedulers requires more
19 than one cell time slot to generate a match from its
20 matching operation, and

21 wherein the subschedulers can collectively
22 generate a match result for each output port in each cell
23 time slot.

1 17. The dispatch scheduler of claim 16 wherein each of the
2 subschedulers requires the third number of cell time slots
3 to generate a match from its matching operation.

1 18. The dispatch scheduler of claim 16 wherein each of the
2 subschedulers require no more than the third number of cell

3 time slots to generate a match results from its matching
4 operation.

1 19. The dispatch scheduler of claim 16 wherein fairness
2 for best-effort traffic is maintained.

1 20. The dispatch scheduler of claim 16 wherein the
2 matching operation is a matching operation selected from a
3 group of matching operations consisting of (A) DRRM, and
4 (B) iSLIP.

1 21. The dispatch scheduler of claim 16 wherein if a cell
2 buffered at a virtual output queue has been successfully
3 matched with its corresponding output port, the virtual
4 output queue is so informed.

1 22. The dispatch scheduler of claim 16 wherein if a cell
2 buffered at a virtual output queue has been successfully
3 matched with its corresponding output port, its head of
4 line cell is dispatched.

1 23. The dispatch scheduler of claim 22 wherein the head of
2 line cell is dispatched in a next cell time slot.

1 24. The dispatch scheduler of claim 16 wherein the first
2 indicator, for each of the virtual output queues, for
3 indicating whether the virtual output queue is storing a
4 cell awaiting dispatch arbitration, is a count,
5 wherein the count is incremented upon learning
6 that a new cell has arrived at the virtual output queue.

1 25. The dispatch scheduler of claim 24 wherein the count
2 is decremented when an available subscheduler is reserved
3 for considering a head of line cell at a corresponding
4 virtual output queue.

1 26. The dispatch scheduler of claim 16 wherein the second
2 indicator, for each of the subschedulers, is set to
3 indicate that the associated subscheduler is reserved if
4 the first indicator indicates that a corresponding virtual
5 output queue is storing a cell awaiting dispatch
6 arbitration.

1 27. The dispatch scheduler of claim 16 wherein the second
2 indicator, for each of the subschedulers, is set to
3 indicate that the associated subscheduler is available if
4 the associated subscheduler matches a cell buffered at a
5 virtual output queue with its corresponding output port.

1 28. The dispatch scheduler of claim 16 wherein the second
2 indicator is set to indicate that a k^{th} subscheduler is
3 reserved if the first indicator indicates that a
4 corresponding virtual output queue is storing a cell
5 awaiting dispatch,
6 wherein k is set to the current cell time slot
7 modulo the third number.

1 29. A machine-readable medium storing information for use
2 with a switch including a first number of output ports, a
3 second number of input ports, and the first number of
4 virtual output queues associated with each of the second
5 number of input ports, and a third number of subschedulers,
6 the machine-readable medium having stored thereon:

- 7 a) a first indicator, associated with each of the
8 virtual output queues, for indicating whether the
9 virtual output queue is storing a cell awaiting
10 dispatch arbitration; and
11 b) a second indicator, for each of the subschedulers,
12 indicating whether the subscheduler is available or
13 reserved.

1 30. The machine-readable medium of claim 29 wherein the
2 first indicator, for each of the virtual output queues, for
3 indicating whether the virtual output queue is storing a
4 cell awaiting dispatch arbitration, is a count,
5 wherein the count is incremented upon learning
6 that a new cell has arrived at the virtual output queue.

1 31. The machine-readable medium of claim 30 wherein the
2 count is decremented when an available subscheduler is
3 reserved for considering a head of line cell at a
4 corresponding virtual output queue.

1 32. The machine-readable medium of claim 29 wherein the
2 second indicator, for each of the subschedulers, is set to
3 indicate that the associated subscheduler is reserved if
4 the first indicator indicates that a corresponding virtual
5 output queue is storing a cell awaiting dispatch
6 arbitration.

1 33. The machine-readable medium of claim 29 wherein the
2 second indicator, for each of the subschedulers, is set to
3 indicate that the associated subscheduler is available if
4 the associated subscheduler matches a cell buffered at a
5 virtual output queue with its corresponding output port.

1 34. For use with a switch having a first number of input
2 ports, a second number of output ports, each of the input
3 ports having the second number of virtual output queues,
4 and a third number of subschedulers, each of the third
5 number of subschedulers being able to arbitrate matching to
6 each of the second number of output ports, a method for
7 scheduling the dispatch of cells or packets stored in the
8 virtual output queues, the method comprising for each of
9 the subschedulers, performing a matching operation, if it
10 has been reserved, to match a cell buffered at a virtual
11 output queue with its corresponding output port,

12 wherein each of the subschedulers requires more
13 than one cell time slot to generate a match from its
14 matching operation,

15 wherein the subschedulers can collectively
16 generate a match result for each output port in each cell
17 time slot, and

18 fairness is maintained for best-effort traffic.

1 35. The method of claim 34 wherein each of the
2 subschedulers requires the third number of cell time slots
3 to generate a match from its matching operation.

1 36. The method of claim 34 wherein each of the
2 subschedulers require no more than the third number of cell
3 time slots to generate a match results from its matching
4 operation.

1 37. The method of claim 34 wherein the matching operation
2 is a matching operation selected from a group of matching
3 operations consisting of (A) DRRM, and (B) iSLIP.